AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently amended) A computer-implemented method of piggybacking a message invalidating cached data on a response to a data request, the method comprising:

in a hierarchy of caches, passing a data request toward a data server;

at an upstream cache, detecting the invalidation of a set of data cached on one or more downstream caches, including a first downstream cache;

in a response to the data request, including a message attached to the response to the first downstream cache to invalidate the set of data; and

forwarding the response toward the first downstream cache.

2. (Original) The method of claim 1, further comprising:

adding the set of data to a list of data to be invalidated on downstream caches.

3. (Original) The method of claim 2, further comprising:

removing the set of data from the list of data after data request responses including messages to invalidate the set of data have been forwarded to each of the one or more downstream caches.

4. (Original) The method of claim 1, wherein the set of data includes data requested in the data request.

5. (Original) The method of claim 1, wherein the set of data includes no data requested in the data request.

6. (Original) The method of claim 1, further comprising, in the first downstream cache:

receiving the response;

retrieving the message;

invalidating the set of data if the set of data is cached on the first downstream cache; and

forwarding the response toward a second downstream cache.

7. (Original) The method of claim 1, further comprising, in the first downstream cache:

receiving the response;

removing the message from the response;

invalidating the set of data if the set of data is cached on the first downstream cache; and

serving the response to a client that initiated the data request.

8. (Original) The method of claim 1, wherein said detecting comprises:

receiving an invalidation message originated by the data server.

9. (Original) The method of claim 1, wherein said detecting comprises:

receiving a manual notification of the invalidation of the set of data.

10. (Original) The method of claim 1, wherein the data request is initiated by a first requestor and the response is targeted to a different requestor.

11. (Original) The method of claim 1, wherein the upstream cache is a cache local to the data server.

12. (Original) The method of claim 1, wherein the upstream cache and the first downstream cache are members of a cache cluster.

13. (Currently amended) A computer readable medium storing instructions that, when executed by a computer, cause the computer to perform a method of piggybacking a message invalidating cached data on a response to a data request, the method comprising:

in a hierarchy of caches, passing a data request toward a data server;

at an upstream cache, detecting the invalidation of a set of data cached on one or more downstream caches, including a first downstream cache;

in a response to the data request, including a message attached to the response to the first downstream cache to invalidate the set of data; and

forwarding the response toward the first downstream cache.

14. (Currently amended) An automated method of asynchronously communicating a side effect of a first data request in a response to a second data request, the method comprising:

in a computing environment comprising a data server and a plurality of caches, processing a first data request to produce a first response;

identifying a side effect of the first data request;

communicating the side effect to a first cache upstream of one or more downstream caches;

at the first cache:

identifying a second response to a second data request;

including notification of the side effect in the second response; and

forwarding the second response including the notification of the side effect toward a first downstream cache; and

at the first downstream cache, applying the side effect.

15. (Original) The method of claim 14, wherein the side effect comprises invalidation of data cached on the first downstream cache.

16. (Original) The method of claim 14, wherein the side effect comprises propagation of cache configuration data.

17. (Original) The method of claim 14, wherein the side effect comprises a password.

18. (Original) The method of claim 14, wherein the side effect comprises an update to a cache program.

19. (Original) The method of claim 14, wherein the side effect comprises a replacement cache program.

20. (Original) The method of claim 14, wherein said applying the side effect at the first downstream cache comprises applying the side effect after forwarding the second response.

21. (Original) The method of claim 20, wherein said applying the side effect at the first downstream cache comprises applying the side effect before a specified event.

22. (Original) The method of claim 14, further comprising:

at the first cache, tracking which of the one or more downstream caches has been notified of the side effect;

wherein a downstream cache other than the first downstream cache receives notification of the side effect in a communication other than the second response.

23. (Currently amended) A computer readable medium storing instructions that, when executed by a computer, cause the computer to perform a method of asynchronously communicating a side effect of a first data request in a response to a second data request, the method comprising:

in a computing environment comprising a data server and a plurality of caches, processing a first data request to produce a first response;

identifying a side effect of the first data request;

communicating the side effect to a first cache upstream of one or more downstream caches;

at the first cache:

identifying a second response to a second data request;

including notification of the side effect in the second response; and

forwarding the second response including the notification of the side effect toward a first downstream cache; and

at the first downstream cache, applying the side effect.

24. (Currently amended) A system for piggybacking notification of a side effect of a first data request in a response to a second data request, comprising:

a data server configured to serve data in response to data requests;

one or more downstream caches configured to cache the served data; and

an upstream cache logically located between the data server and the one or more downstream caches, wherein the upstream cache is configured to include, in

a response to one data request from the downstream cache, notification of a first side effect of a different data request.

25. (Original) The system of claim 24, wherein the upstream cache comprises:

a subscription table identifying each of the one or more downstream caches; and

a list of side effects that the one or more downstream caches are to be notified of.

26. (Original) The system of claim 25, wherein the upstream cache is further configured to remove the first side effect from the list of side effects after each of the one or more downstream caches have been notified of the first side effect.

27. (Original) The system of claim 24, wherein the first side effect comprises the invalidation of a set of data.

28. (Original) The system of claim 24, wherein:

the one or more downstream caches include a final downstream cache coupled to a client that initiated the one data request; and

the final downstream cache is configured to remove the notification of the first side effect of the different data request from the response before serving the response to the client.

29. (Original) The system of claim 24, wherein the upstream cache is a local cache of the data server.